10.

Notes on Some New York Oribatid Mites.

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(Text-figures 1-16).

These notes on the New York Oribatei (Acarina) were compiled as a result of a mounting demand for wider knowledge of these relatively little-known animals. Much impetus was given to the investigation of this particular group of mites by the discovery of Stunkard (1937) that oribatid mites are the intermediate host of the anoplocephaline cestodes. Oribatid mites from the metropolitan New York area were collected and examined. This article presents a list of the mites collected, including original drawings of eight species which have been hitherto poorly figured, with notes on ecology, methods of collection and mounting.

In view of the meagre descriptions and inadequate figures in the literature today, such information should prove of value to future workers in this field. Although A. P. Jacot (1929, 1932, 1934, 1935, 1937) has admirably described and figured the galumnid and phthiracarinid mites of the northeastern United States, the remainder of the oribatids from this area have not been studied since the early papers of Nathan Banks (1895, 1906, 1907, 1915) and H. E. Ewing (1907, 1909). There have been isolated instances of excel'ent descriptions of oribatids from the eastern United States, but in most cases, such as Kates & Runkel (1948), these papers have mentioned only a few species. No one in this country has made any compilation of this interesting group of mites such as A. D. Michael (1884, 1888) did for the British Oribatidae and C. Willman (1931) did for the German "Moosmilben." This study, then, can be an introduction to a more complete account of the American Oribatei, which the writer hopes to prepare in the future.

The writer gratefully acknowledges the assistance of Dr. H. W. Stunkard, of the Biology Department of New York University, who not only encouraged him in the preparation of this report, but materially aided in the writing of this manuscript, and Dr. E. W. Baker, of the U. S. Bureau of Entomology and Plant Quarantine, for his invaluable aid in the identification of the oribatid mites. Gratitude is also extended to E. I. duPont de Nemours & Co. for their generosity in forwarding samples of various grades of Elvanol for experimentation with polyvinyl alcohol (PVA) for mounting media.

Ecology.

According to Willman (1931), oribatids live in moss, in the humus of the forest floor, in lichens growing over tree stumps and trees, free on twigs and leaves, in decaying wood and in the sphagum of marshes, a few being slightly aquatic and still fewer known to inhabit the sea. They are found everywhere where plants decay with sufficient moisture and are penetrated by mycelia.

Material was collected from the following localities: (a), wooded, mossy area in Van Cortlandt Park; (b), University Heights campus, New York University; (c), wooded, dry area near Yonkers, New York; (d), mossy, damp slope behind the Reptile House, Bronx Zoo. Subsequently the following list of environments and their oribatid fauna was prepared:

Very Wet Moss
Trimalaconothrus angulatus
Carabodes areolatus
Melanozetes meridianus
Galumna emarginatum
Pseudotritia ardua
Hoploderma magnum

Humus
Platyliodes scaliger
Oribatula minuta
Zygoribatula clavata
Scheloribates laevigatus

Drier Moss
Hypochthonius rufulus
Platyliodes scaliger
Oppia nitens
Oppia splendens
Scheloribates latipes
Scheloribates laevigatus
Galumna emarginatum
Notaspis punctatus
Pseudotritia ardua

Fallen Leaves
Hypochthonius rufulus
Nothrus rugulosus
Oppia neerlandica
Oribatula minuta
Zygoribatula clavata
Scheloribates latipes
Notaspis punctatus

Moss on Trees
Tectocepheus velatus
Carabodes areolatus
Protokalumma depressum
Pseudotritia ardua
Nothrus rugulosus (also under bark)

Sphagnum
Hypochthonius rufulus
Trhypochthonius ba tus
Pseudotritia ardua

Collecting Methods.

The above list reveals that the greatest number of different species of oribatid mites were collected from moss. Various authors (Willman, 1931; Jacot, 1936, 1940; Krull, 1939; Soldatova, 1945; Pearse, 1946; Kates

& Runkel, 1948) report that the humus layer of the soil where the organic content is very high provides the optimum conditions for their recovery.

There are three methods available to obtain a high percentage of the organisms inhabiting this humus layer: the washing-screening-flotation method of Krull (1939); the modified Berlese funnel method described by Trägårdh (1933), Jacot (1936), Potemkina (1941) and Starling (1944); the modified Tullgren apparatus as described by Willman (1931).

The method of Krull was discarded on the basis of the results of Kates & Runkel (1948), who stated that the drying-cone methods (Berlese and Tullgren apparatus) "require much less time and labor to recover mites from equivalent quantities of turf and caused less injury to the mites."

The mode of action of the last two methods is essentially the same; the negatively phototropic and moisture-loving animals are driven by gradual drying to abandon their environment and fall through a funnel into a collecting vessel placed underneath. In the Berlese apparatus the funnel is surrounded by a mantle filled with water. The water is heated by a Bunsen burner, and from the inside of the funnel there results a rising warm air stream which dries out the moss from underneath. The Tullgren apparatus seems to be more practical and is the type employed in this investigation. The cone used had a top diameter of 18 inches. A 200-watt electric light, suspended about 3 inches over the material in the cone, provided the heat for the gradual drying of the material and light for the downward migration of the mites. A 20-mesh screen, placed on flanges 4 inches from the open top of the funnel, was overlaid with a triple layer of gauze, and the collected sample of moss, leaves, etc., placed on this gauze. This screen is removable to provide easy access in cleaning the apparatus. The sample was then spread out so that it was not more than 1 inch in thickness. By this procedure, in 24-36 hours one can reckon with certainty that (apart from the microfauna) all the animals have left the collected material. The half-pint fruit jar, the lid of which was pierced by and soldered to the open cone vent, is then unscrewed, and in the inch or so of water provided within to keep the animals living, will be found a variegated throng of mites, insects, worms, and whatever else had found its way into the examined material.

This apparatus corresponds quite closely to that described by Kates & Runkel (1948) as a modified Berlese funnel. From the descriptions in the literature it would seem to be more correctly labelled a modified Tullgren apparatus.

The contents of the jar were then poured into a porcelain disk filter in which 1 or 2 filter papers had previously been placed. After filtration, the filter paper was laid on a glass plate and put under a dissecting microscope. The oribatids were then removed by means of a small camel's hair brush, and placed in small containers for future study.

Permanent Mounting for Study and Identification.

Many slides were made following the method described by Kates & Runkel (1948). They first killed the mites in 70% alcohol and then mounted them directly on a glass slide in a polyvinyl-alcohol (PVA)-lactic acid medium (Downs, 1943). Living mites were mounted in the same manner without the preliminary treatment with alcohol.

While this method is quick and satisfactory for the very small and the immature specimens, the use of various PVA media for mounting and clearing the larger oribatids, especially the galumnids, proved entirely unsatisfactory. These PVA preparations shrank a great deal, crushing and distorting the mites.

Dr. Edward W. Baker recommended the following modified Berlese medium:

distilled water	50 g.
gum arabic	30 g.
chloral hydrate	200 g.
glycerine	20 g.

This also is water soluble, and mites can be mounted directly as in the case of the PVA. Mounts of this kind are alleged to have held up for twenty years or more. This medium can be used not only for the more delicate species, but also for those which are more robust. However, for the larger specimens, it is recommended that the mounts be built up to contain the mite and support the cover glass. For making such cells, asphaltum rings proved very efficient and practicable.

Mites mounted by both of these methods were clear enough for study in a few hours to several days, depending upon the opacity of the specimens. The consistency can be varied to suit the user. The thicker the medium, the sooner could the examination be made, especially where it is necessary to turn the slide over for study of dorsal and ventral surfaces. The PVA media hardened, as a rule, more quickly than that of Berlese.

Although it is possible to study adult oribatid mites of all species mounted in these two media, no completely satisfactory method of clearing adult specimens of the more opaque species, such as galumnid mites, was discovered. Kates & Runkel found that excellent preparations could be made of these heavily pigmented species by mounting young specimens having all adult features except the deep brown color in the exoskeleton. Hydrogen peroxide has been tried with some success. Galumnids were immersed in a strong solution of hydrogen peroxide for several days and then mounted in the PVA-lactic acid medium. A definite clearing action was noted, and although the setae were not as distinct as before, the overall result indicated that more experimentation with this method might be one answer to this problem.

Oribatid Mites Collected in This Investigation.

The classification of mites collected in this investigation follows closely that of Willman (1931), and was used on the suggestion of Dr. Edward W. Baker.

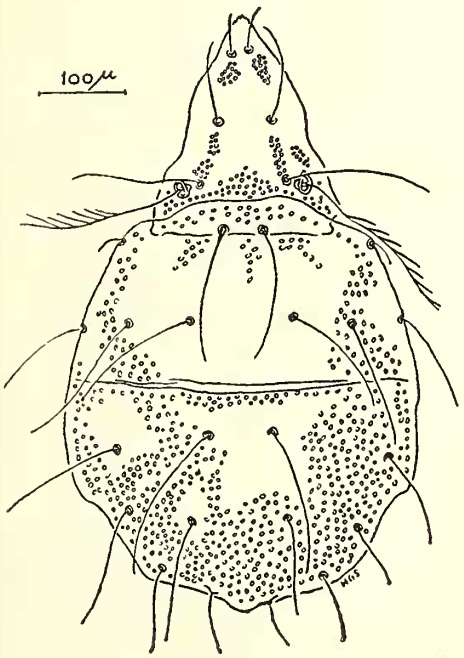
Order Acari Leach, 1817.
Suborder Sarcoptiformes Reuter, 1909.

SUPERCOHORS ORIBATEI DUGÈS, 1834.

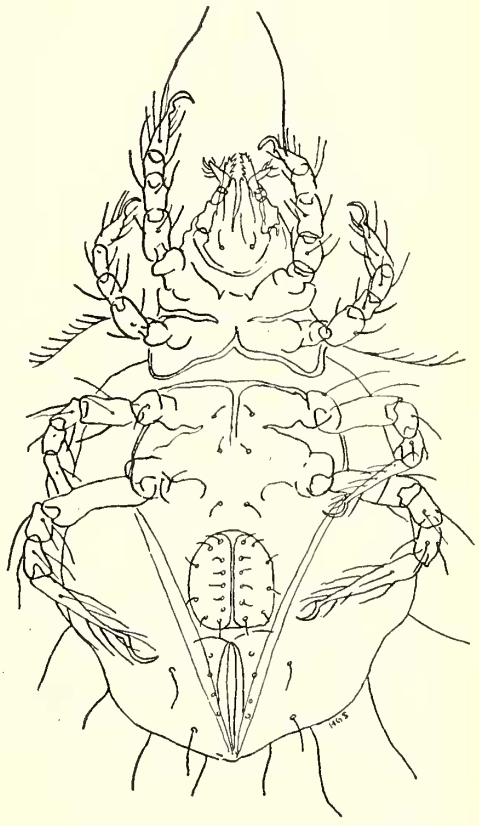
Cohors Aptyctima Oudemans, 1906.

1. Family Hypochthoniidae.
   a. *Hypochthonius rufulus* C. L. Koch, 1835. Text-figs. 1 & 2[1].
   (*Hypochthonius ruf., Leiosoma ovata* Nymphe). (Koch, 1835, Fasc. 3, Nr. 19; Michael, 1888, p. 534, Plate 49, Figs. 6-13; Nicolet, 1855, p. 395, Plate 2, Fig. 5).
   b. *Trhypochthonius badius* (Berlese), 1904. Text-figs. 3 & 4[1].
   (Berlese, 1904, p. 237; Sellnick, 1928, p. 22).
2. Family Malaconothridae.
   a. *Trimalaconothrus angulatus* Willman, 1931. Text-figs. 5 & 6[1].
   (Willman, 1931, p. 107, Figs. 46 & 46a).
3. Family Camisiidae.
   a. *Nothrus rugulosus* Banks, 1895. Text-figs. 7 & 8[1].
   (Banks, 1895, p. 15).
4. Family Neoliodidae.
   a. *Platyliodes scaliger* (C. L. Koch), 1840.
   (Koch, 1840, Fasc. 29, Nr. 11; Sellnick, 1927, p. 27, Figs. 5-9; Sellnick, 1928, p. 24; Willman, 1931, p. 116, Figs. 85a, b).
5. Family Eremaeidae.
   a. *Oppia neerlandica* (Oudemans), 1900. Text-figs. 9 & 10[1].
   (*Eremaeus n., Dameosoma corrugatus, D. neerlandicum, D. uliginosum*). (Oudemans, 1900, p. 168; Paoli, 1908, p. 62; Willman, 1919, p. 554; Sellnick, 1928, p. 35; Willman, 1928, p. 164).
   b. *Oppia splendens* (C. L. Koch), 1840.
   (*Dameosoma* sp., *Notaspis* sp.). (Koch, 1841, Fasc. 32, Nr. 6; Michael, 1888, p. 393, Plate 33, Figs. 10-15; Paoli, 1908, p. 52, Plate 3, Fig. 15; Sellnick, 1928, p. 35).
   c. *Oppia nitens* (C. L. Koch), var. *myrmecophila* (Sellnick), 1928.
   (*Dameosoma n.* var. *m.*). (Sellnick, 1928, p. 36).

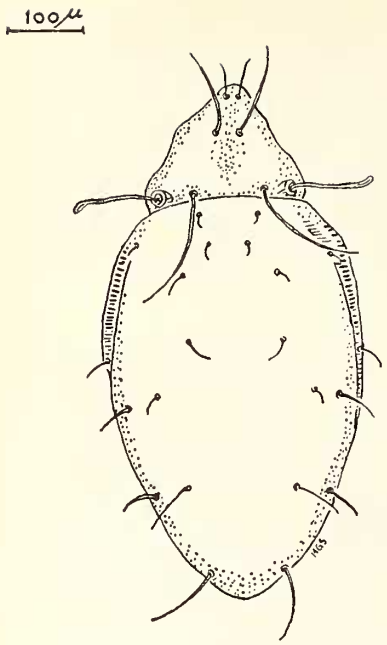
[1] Original camera lucida drawings.



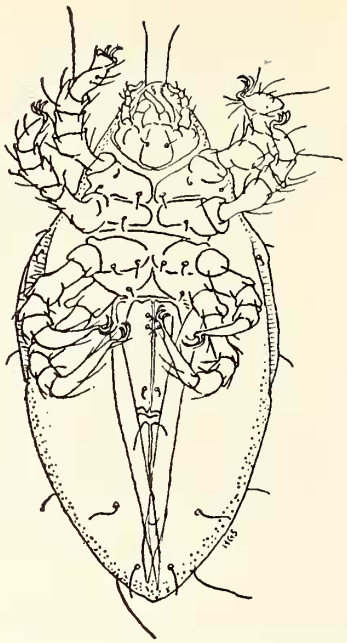
Text-fig. 1. *Hypochthonius rufulus.* Dorsal view. 700μ × 414μ.



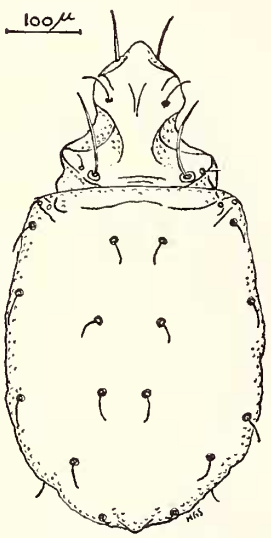
Text-fig. 2. *Hypochthonius rufulus.* Ventral view.



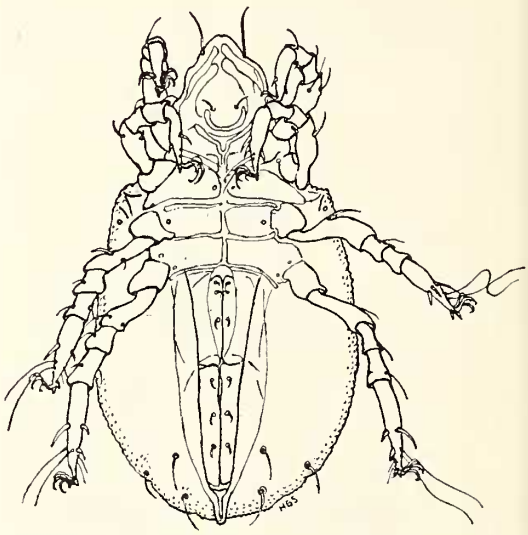
TEXT-FIG. 3. *Trhypochthonius badius.* Dorsal view. 672μ × 350μ.



TEXT-FIG. 4. *Trhypochthonius badius.* Ventral view.



TEXT-FIG. 5. *Trimalaconothrus angulatus.* Dorsal view. 658μ × 358μ.



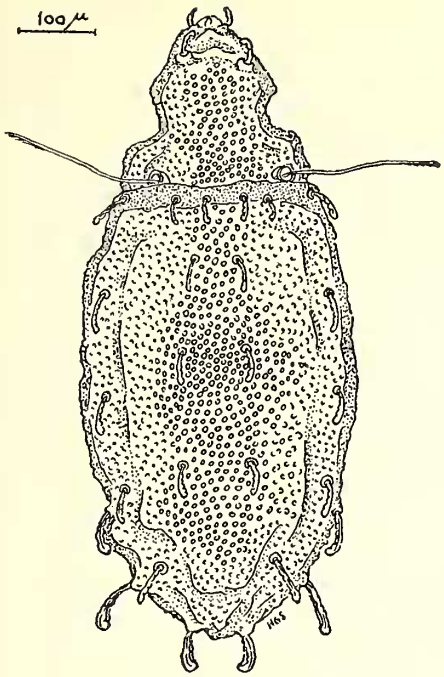
TEXT-FIG. 6. *Trimalaconothrus angulatus.* Ventral view.

6. Family Carabodidae.
   a. *Tectocepheus velatus* (Michael), 1880. Text-figs. 11 & 12[1]. (*Tegocranus v.*), (Michael, 1884, p. 313, Plate 31, Figs. 9-15; Berlese, 1895, Fasc. 77, Nr. 2; Sellnick, 1928, p. 28).
   b. *Carabodes areolatus* Berlese, 1916. Text-figs. 13 & 14[1]. (Berlese, 1916, III, p. 333; Sellnick, 1928, p. 29).

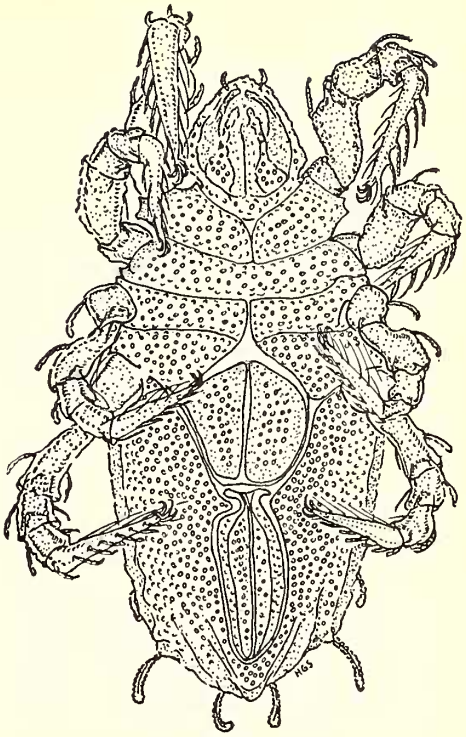
[1] Original camera lucida drawings.

7. Family Oribatulidae.
   a. *Oribatula minuta* (Banks), 1896. (*Oribatella m.*). (Banks, 1896, p. 76).
   b. *Zygoribatula clavata* (Ewing), 1917. (*Oribatula c.*). (Ewing, 1917, p. 162).

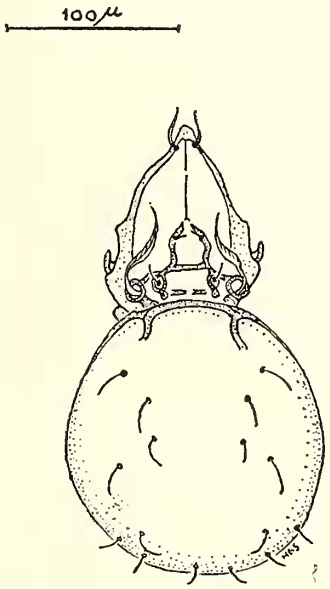
8. Family Notaspididae.
   a. *Scheloribates latipes* (C. L. Koch), 1844. Text-figs. 15 & 16[1]. (*Zetes l., Oribates l.*). (Koch, 1844, Fasc. 38, Nr. 14; Berlese, 1888, Fasc. 30, Nr. 3; Sellnick, 1928, p. 16).



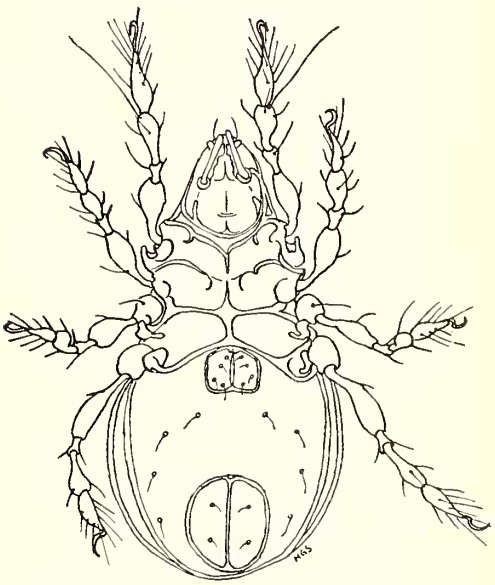
TEXT-FIG. 7. *Nothrus rugulosus.* Dorsal view. 815μ × 400μ.



TEXT-FIG. 8. *Nothrus rugulosus.* Ventral view.



TEXT-FIG. 9. *Oppia neerlandica.* Dorsal view. 257μ × 143μ.



TEXT-FIG. 10. *Oppia neerlandica.* Ventral View.

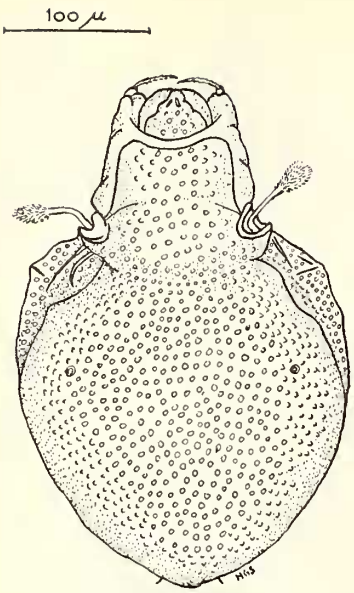
b. *Scheloribates laevigatus* (C. L. Koch), 1836. (*Zetes l.*). (Koch, 1836, Fasc. 3, Nr. 8; Sellnick, 1928, p. 16).

c. *Melanozetes meridianus* Sellnick, 1928. (Sellnick, 1928, p. 12).

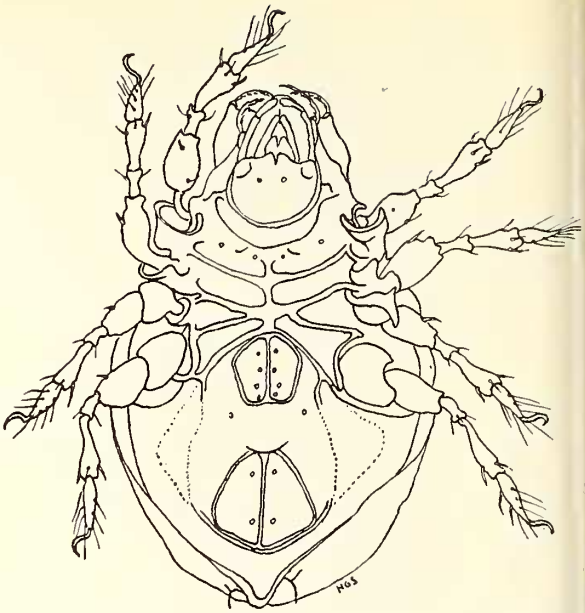
d. *Protokalumma depressum* Jacot, 1933. (Jacot, 1933, Plate 13).

e. *Galumna emarginatum* (Banks), 1895. (*Oribata e.*). (Banks, 1895, p. 7).

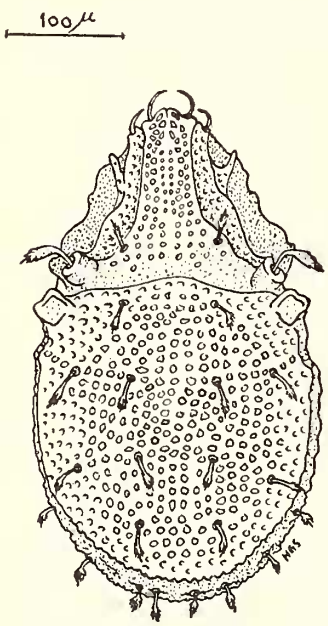
f. *Notaspis punctatus* (Nicolet), 1855. (*Oribata p.*). (Nicolet, 1855, p. 434,



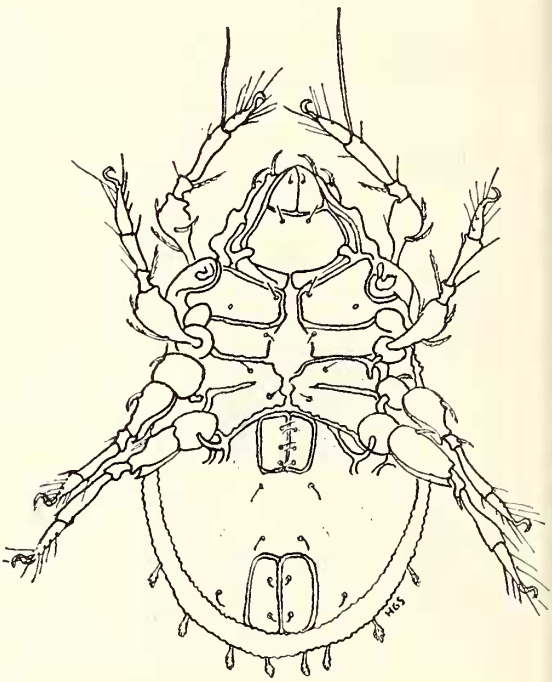
TEXT-FIG. 11. *Tectocepheus velatus.* Dorsal view. 333μ × 214μ.



TEXT-FIG. 12. *Tectocephus velatus. Ventral view.*



TEXT-FIG. 13. *Carabodes areolatus.* Dorsal view. 429μ × 257μ.



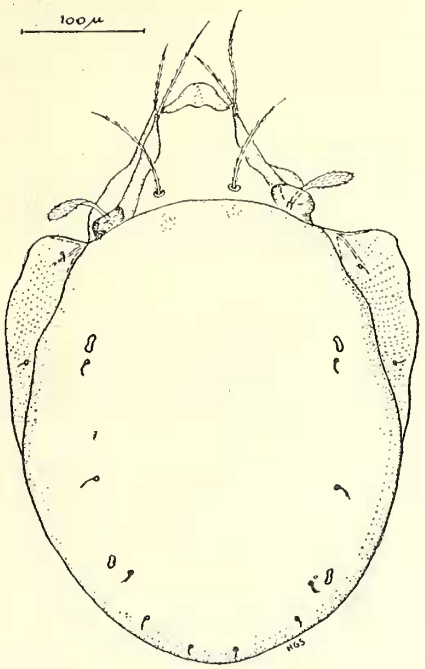
TEXT-FIG. 14. *Carabodes areolatus.* Ventral view.

Plate 4, Fig. 7; Michael, 1884, p. 253, Plate 9, Figs. 1-14; Oudemans, 1913, p. 40; Oudemans, 1925, p. 126).

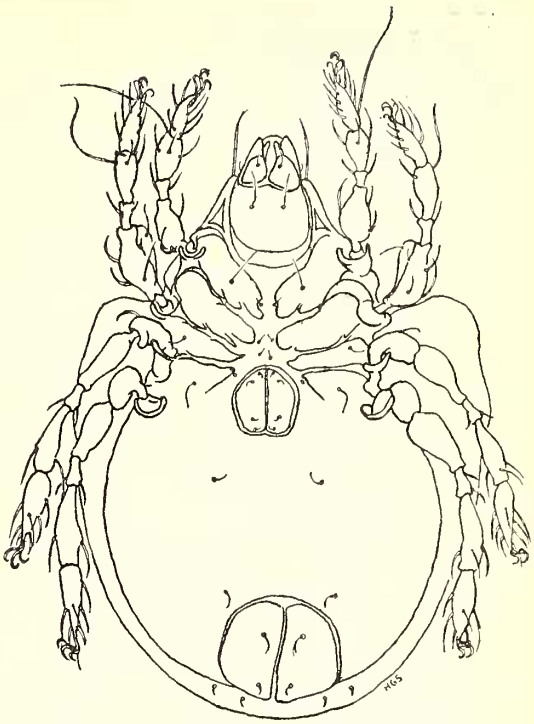
9. Family Haplozetidae.
   a. *Haplozetes* sp. (Willman), 1935. (Willman, 1935, p. 339-340).

COHORS PTYCTIMA OUDEMANS, 1906.

10. Family Phthiracaridae.
    a. *Hoploderma magnum* (Nicolet), 1855. (*Hoplophora m., Phthiracarus m.*). (Nicolet, 1855, p. 472, Plate 10, Fig. 4; Michael, 1888, p. 556, Plate 50, Figs.



TEXT-FIG. 15. *Scheloribates latipes.* Dorsal view. 472μ × 333μ.



TEXT-FIG. 16. *Scheloribates latipes.* Ventral view.

1-7; Berlese, 1892, Fasc. 67, Nr. 9; Oudemans, 1915, p. 218; Sellnick, 1928, p. 40).

b. *Pseudotritia ardua* (Koch), 1841. (*Tritia lentula* ?, *Acrotritia sinensis*, *P. pectinatus*). (Koch, 1841, Fasc. 32, Nr. 15; Berlese, 1887, Fasc. 36, Nr. 3; Sellnick, 1923, p. 12, Figs. 1, 12, 23, 24; Jacot, 1923; Ewing, 1917; Jacot, 1930, Plate 38, Figs. 44-51).

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